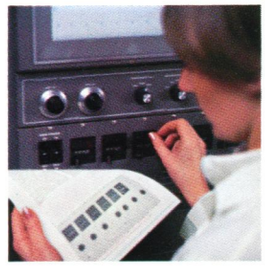
# SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

12 August 1977, Volume 197, No. 4304


# New Model 119CL. The simple-to-use amino acid analyzer with high sensitivity and fast analysis.


Now many of the advantages of the world's most sophisticated analyzers can be obtained in a simple-to-use instrument: the new Model 119CL. It analyzes hydrolyzate samples in only 1½ hours and physiological fluids in only 4½ hours, including regeneration and equilibration. And it offers half-nanomole sensitivity.



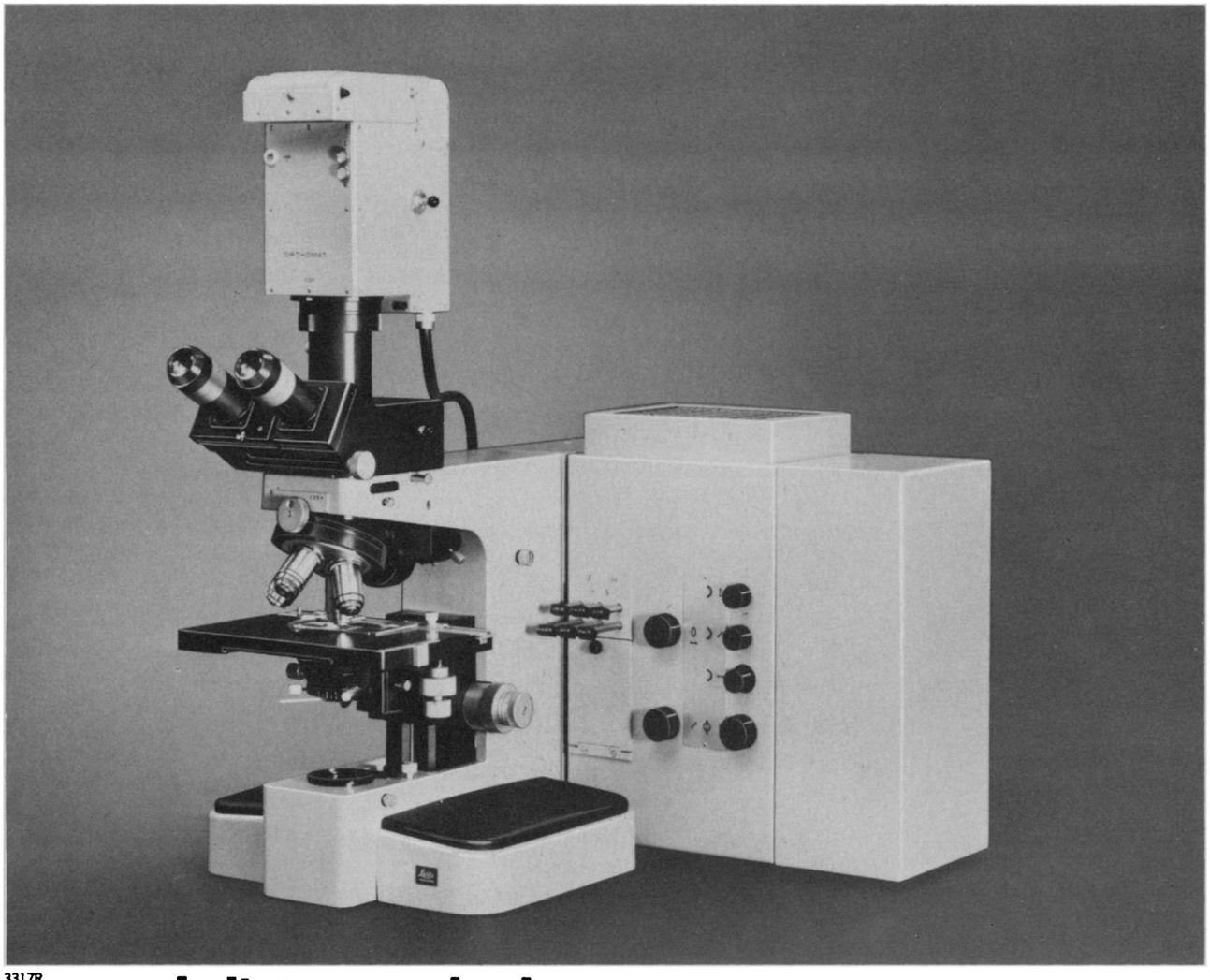
All of these advantages are achieved without sacrificing any of the time-tested features that have made the economical 119 Series so popular in laboratories throughout the world: easily set programs, single-column methodology, automatic sample injection — and many more. In addition, the new Model 119CL has automatic pressure monitoring for added sample protection, and a new high-precision data system — the Model 126.

This outstanding value in amino acid analyzers is described in Brochure SB-428; for a copy write Beckman Instruments, Inc., Spinco Division, 1117 California Avenue, Palo Alto, CA 94304.

**BECKMAN®**

Circle No. 137 on Readers' Service Card

Orthoplan® with fully automatic Leitz 35mm camera and high-intensity light source.



3317R

# Leitz® research microscopes: they change when you change.

Leitz microscopes adapt to every microscopical technique available today. The Leitz building block concept is why. A host of easily-interchangeable accessories: nose-pieces, tubes, stages, cameras, light sources, video monitors, and the Leitz MPV-2 photometer system permit virtually unlimited applications. These microscopes are perfectly suited to your observation methods and easily changeable for new requirements.

| | Orthoplan | Ortholux | Dialux |
|---|---|---|---|
| Brightfield/darkground, polarized light | ✔ | ✔ | ✔ |
| Phase contrast | ✔ | ✔ | ✔ |
| Intereference contrast | ✔ | ✔ | ✔ |
| Fluorescence | ✔ | ✔ | ✔ |
| Drawing attachment | ✔ | ✔ | ✔ |
| Projection attachment | ✔ | ✔ | ✔ |
| Photomicrography | ✔ | ✔ | ✔ |
| Cinemicrography | ✔ | ✔ | ✔ |
| Interferometry | ✔ | ✔ | ✔ |
| Microscope photometry | ✔ | ✔ | |
| Quantatitive image analysis | ✔ | | |
| Field-of-view index | 18;24;28 | 18 | 16;18 |

Newly developed Leitz planapochromatic objectives assure highest attainable resolution with absolutely flat images even for the super-wide 28mm field.

As the chart shows, the Leitz Ortholux II and Dialux microscopes feature most of the Orthoplan's capabilities at somewhat lower prices.

For details, call 201-767-1100 or write E. Leitz, Inc., Dept. SC8 Rockleigh, N.J. 07647.

Leitz®

Where most new developments start.

12 August 1977

Volume 197, No. 4304

# SCIENCE



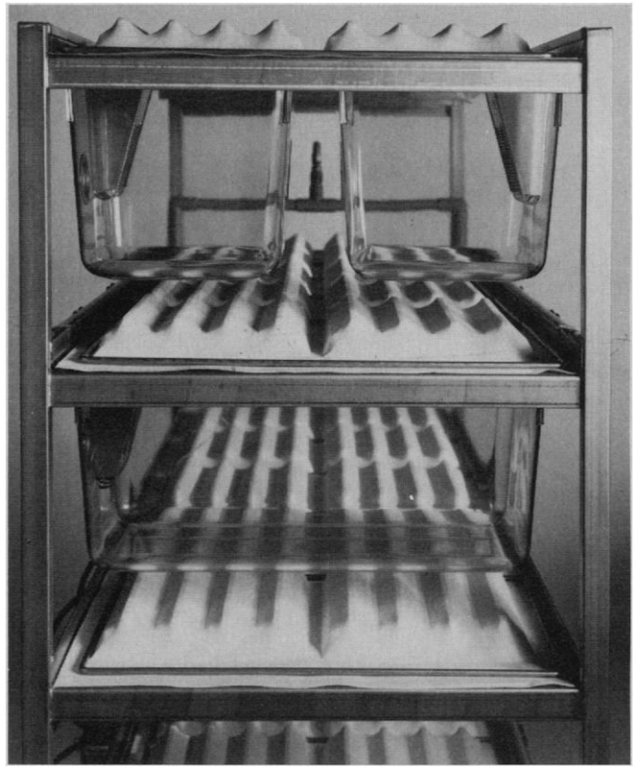


**SCIENCE is published weekly, except the last week in December, but with an extra issue on the third Tuesday in September, by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005.** Now combined with **The Scientific Monthly®**. Second-class postage paid at Washington, D.C., and additional entry.  Member rates on request. Annual subscriptions $60; foreign postage: Canada $10; other surface $13; air-surface via Amsterdam $30. Single copies $2 (back issues $3) except **Guide to Scientific Instruments** $6. School year subscriptions: 9 months $45; 10 months $50. Provide 6 weeks' notice for change of address, giving new and old addresses and postal codes. Send a recent address label, including your 7-digit account number. **Postmaster: Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.** ***Science*** is indexed in the **Reader's Guide to Periodical Literature.**

**COVER**

The collapse of adobe dwellings was the main cause of death and injury following the earthquake in Guatemala, as it has been in other areas of Latin America. Epidemiologic study of the relation between house construction and health effects following earthquakes can provide clues for the prevention of death and injury in areas of the world prone to these natural disasters. See page 638. [Roger I. M. Glass, Center for Disease Control, Atlanta, Georgia 30333]

**1.** Mobile stainless steel rack with suspended polycarbonate cages.



**2.** Disposable formed plenum filters shown above cages. Flat filter sheets also available.

# See-Through™ suspended cage systems
# The most versatile small animal housing systems available.

## (So many options...you "build" it to your own specs.)

Basically, this system involves a mobile stainless steel rack with suspended polycarbonate cages.
*Two* rack sizes are available: the large rack accommodates either 60 small cages, or 30 large cages, or *combinations* of both size cages. The *new* smaller rack size takes either 50 small cages, or 25 large cages, or *combinations* of both.
This See-Through™ system is ideal for housing rats, mice, hamsters, and guinea pigs.

**The many other options**
Cage sizes: 10½" x 9½" x 8" deep or 19" x 10½" x 8" deep.

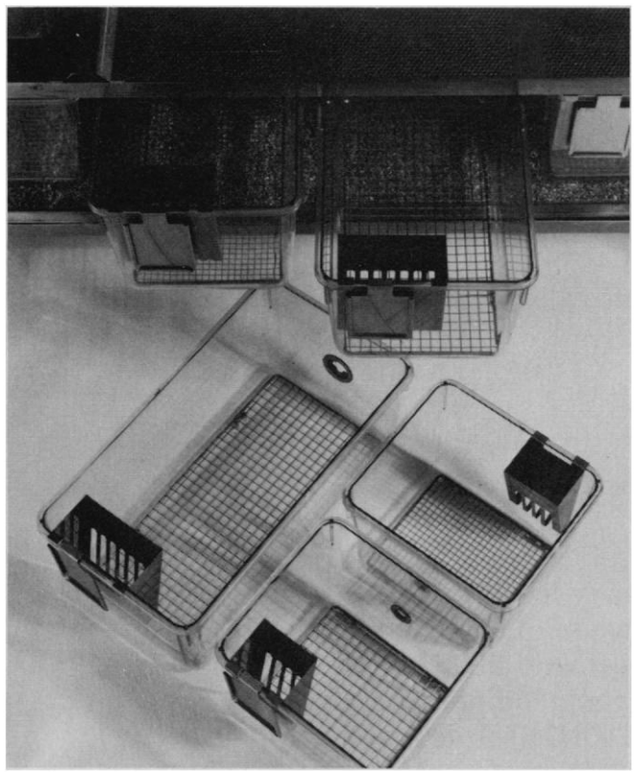
Cage bottoms: solid or stainless steel wire mesh.

Walkfloor mesh: 2 x 2 (for rats) or 3 x 3 (for mice).

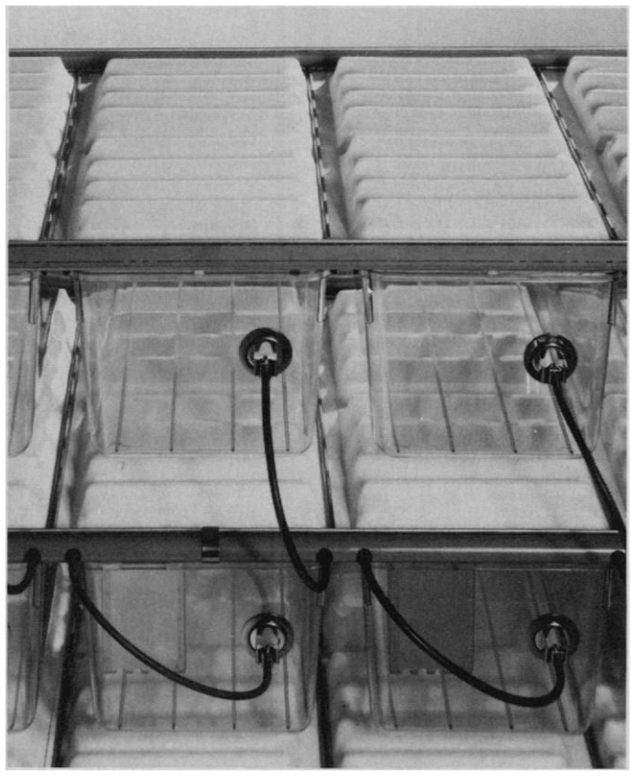
Food hoppers: Four available (for rats, mice, and guinea pigs).

Watering systems: Bottle or automatic (many variations available).

Filtering systems: New disposable formed plenum polyester spun-bonded filter that provides at least 100% more filter area than flat sheet filters. Effective in reducing cross-contamination and in minimizing the stress of a high ammonia atmosphere. Also available: autoclavable filters.



**3.** Rack accommodates small or large cages or combinations of both.



**4.** One available automatic watering system shown; other automatic systems or bottle watering also available.

**Other important features/benefits**
Of fundamental importance regardless of how you "build" your See-Through system initially to meet your current needs, its flexibility assures easy modification to your *future* requirements. And in an era where change is inevitable and budgets tight, this kind of foresight can substantially reduce "future shock."

No separate cage lids! Each cage is suspended from the shelf above, and that shelf is *perforated.* Accordingly, the *perforated* shelf itself serves as the "lid" for the cage immediately below. No initial lid cost. No subsequent handling. No replacement.

Visibility. As the See-Through name implies and the photos demonstrate, animal observation is completely unimpaired.

Excreta trays. Easily removable.

**New Product!**
See-Through II: meets ILAR's new housing specifications (see "Guide for the Care and Use of Laboratory Animals"). 8" deep cage with 200 sq. in. floor area at dead bottom houses 5 rats. 6" deep cage with 75 sq. in. floor at dead bottom houses 5 mice.

Circle No. 96 on Readers' Service Card

For more information about the most versatile small animal housing available, white or call Lab Products Inc., 365 W. Passaic St., Rochelle Park, N.J. 07662 (phone: 201/843-4600)

Why not also request our complete catalog?

**lab products inc** a BioMedic company

**Lab Products...not just plastic cages, metal cages, custom fabrication, laminar flow systems, bedding, automatic watering systems, accessories...**

# FROM MILES RESEARCH PRODUCTS

MILES RESEARCH PRODUCTS

# AFFINITY CHROMATOGRAPHY MATERIALS

## SHALTIEL HYDROPHOBIC CHROMATOGRAPHY KITS

Prof. Shaltiel and co-workers at the Weizmann Institute of Science have introduced the use of homologous series of hydrocarbon-coated agaroses* for separation and purification of proteins. This approach makes use of differences in sizes and distribution of available hydrophobic pockets or regions in proteins, and of lipophilic interactions between these pockets and hydrocarbon chains in the agarose beads.

**Kit I. Alkyl-Agaroses**
The kit consists of six pre-packed columns containing 1 ml of an alkyl agarose of the general formula Agarose-$(CH_2)_n$-H, where n = 0, 2, 4, 6, 8 and 10.

**Kit II. $\omega$-Amino Alkyl Agaroses**
The kit consists of six pre-packed columns containing 1 ml of an $\omega$-amino alkyl agarose of the general formula Agarose-$(CH_2)_n$-$NH_2$ where n = 0, 2, 4, 6, 8 and 10. Each kit contains detailed instructions and can be used to determine the appropriate gel for preparative work. Individual components are available in larger quantities. Please inquire concerning your specific needs.

| Description | Code No. | Pkg. Size |
|---|---|---|
| Hydrophobic Chromatography Kit I. | 62-060-1 | 1 Kit |
| Hydrophobic Chromatography Kit II. | 62-085-1 | 1 Kit |
| Each kit contains 6 columns | | |

*U.S. Patent No. 3,917,527

Circle No. 105 on Readers' Service Card

## SPACER GELS
### MULTIVALENT HYDROPHILIC SPACER GELS

In 1973 Wilchek described the preparation and use of poly-L-lysine agarose and poly-DL-alanine poly-L-lysine agarose derivatives. These gels offer the advantages of introducing a multi-point attached hydrophilic spacer arm. Thus, spacer-ligand leaching is reduced and non-specific interactions with the gel are minimized.

1. POLY-L-LYSINE AGAROSE (PL-AGAROSE)
   Has free amino groups for coupling to ligands containing carboxylic groups.
2. SUCCINYL-POLY-L-LYSINE AGAROSE (SPL-AGAROSE)
   Has free carboxyl groups to enable coupling to ligands containing free amino groups.
3. POLY-DL-ALANINE POLY-L-LYSINE AGAROSE (PAL-AGAROSE)
   Multivalent, hydrophilic spacer gel with amino groups far removed from the matrix.
4. SUCCINYL-POLY-DL-ALANINE-POLY-L-LYSINE AGAROSE (SPAL-AGAROSE)
   Carboxyl derivative for coupling to ligands containing free amino groups.

| Description | Code No. | Pkg. Size |
|---|---|---|
| PL-AGAROSE | 62-070-1 | *50 ml |
| SPL-AGAROSE | 62-071-1 | *50 ml |
| PAL-AGAROSE | 62-072-1 | *50 ml |
| SPAL-AGAROSE | 62-073-1 | *50 ml |
| *Settled gel volume | | |

RESEARCH PRODUCTS

MILES

Research Products
Miles Laboratories, Inc.
Elkhart, Indiana 46514
Phone: 219-264-8804

Miles Laboratories, Ltd.
Post Office Box 37, Stoke Poges
Slough, England SL 2 4 LY
Phone: Farnham Common 2151

## SPACER GELS
### CHARGE-FREE SPACER GELS

The preparation of hydrazide agarose by a one step procedure was described by Lamed, Levin and Wilchek in 1973. This gel offers an amine-containing spacer support that is free of charges at neutral pH. Although particularly suited to nucleotide immobilization, it can be further derivatized to increase its versatility.

Capitalizing on the advantages of the hydrazide materials, Wilchek and Miron in 1974 published on a further refinement using polyacrylic hydrazide. This hydrazide derivative retains the properties of acrylamide polymers, as well as of agarose in that it lacks charged groups even after coupling of the ligand. Through use of this material a multipoint attachment is possible thus reducing leaching difficulties.

1. ADIPIC-HYDRAZIDE-AGAROSE
   Has hydrazide groups on a $C_6$ spacer for coupling of ligands containing free carboxylic groups or insolubilization of periodate oxidized nucleotides.
2. SUCCINYL-ADIPIC-HYDRAZIDE AGAROSE
   Succinyl derivative with carboxylic groups for coupling to ligands containing free amino groups.
3. POLYACRYLIC-HYDRAZIDE-AGAROSE
   Has hydrazide groups on a linear polymer of acrylate.
4. SUCCINYL-POLYACRYLIC-HYDRAZIDE AGAROSE
   A carboxylic derivative of the above referenced product for coupling of ligands with free amino groups.

| Description | Code No. | Pkg. Size |
|---|---|---|
| Adipic Hydrazide Agarose | 62-074-1 | *50 ml |
| Succinyl Adipic Hydrazide Agarose | 62-075-1 | *50 ml |
| Polyacrylic Hydrazide Agarose | 62-076-1 | *50 ml |
| Succinyl Polyacrylic Hydrazide Agarose | 62-077-1 | *50 ml |
| *Settled gel volume | | |

## LETTERS

### Cogeneration in West Germany

Amory B. Lovins, in his letter to *Science* (24 June, p. 1384), states that ". . . President Carter's speechwriters may have taken the incorrect cogeneration figure for West Germany from the same source I did," referring to his article in the October 1976 issue of *Foreign Affairs*. Lovins then identifies the "incorrect" source as our report (*1*). On page 6 of our report we said:

> In West Germany, a much larger proportion of the electrical energy is generated by self-producers (principally industrial establishments), rather than utilities, as indicated in the following tabulation.

| | United States | West Germany |
|---|---|---|
| Utilities | 94.3% | 71.5% |
| Self-producers | 5.7 | 28.5 |

> Of the West German industrial (excluding railroads) net production, 59 percent goes for their own use. The generation (and sale) of this much surplus electricity suggests a wider practice of the energy-conserving techniques of combining the generation of electricity and process heat in West German industry.

We did not identify how much of the 28.5 percent of electricity generated by self-producers represented cogeneration, and did not mean to imply that all of it did. Since then, R. H. Williams has determined that 12 percent of electricity generation in West Germany represents cogeneration, which corroborates our suggestion that the practice is more widespread in West Germany than in the United States.

RONALD K. WHITE
RICHARD L. GOEN
*Stanford Research Institute, Menlo Park, California 94025*

#### References and Notes

1. R. L. Goen and R. K. White, *Comparison of Energy Consumption Between West Germany and the United States* (Stanford Research Institute, Menlo Park, Calif., June 1975).

### "Lovins' Fever"?

As usual, Allen L. Hammond and William D. Metz have done a fine job in summarizing the vagaries of the federal program in solar energy R & D (Research News, 15 July, p. 241). Unfortunately, and not surprisingly, this critique shows evidence that they, like so many others, have caught "Lovins' fever"—for which there is no known antidote.

Without any great hope that further analysis can really change minds, I think it may be worth reminding the readers of *Science* of several unresolved difficulties before they begin to bang on ERDA's (the Energy Research and Development Administration's) door.

1) To assert that solar energy is fundamentally different from other energy sources because it is "democratic" is, indeed, a beautiful thought. But examinations of decentralized solar systems which would provide temperature conditioning and electricity to communities indicate they will be more "democratic" for the well-to-do located in the suburbs than for the lower-income groups in urban centers.

2) Assessments of on-site solar systems to the contrary, no one has articulated in any detail—let alone determined—the energy system-wide effects of meeting a substantial fraction of total final energy demands at a regional level through the use of such distributed energy technologies. These effects may include added costs to consumers still relying on utilities, a decrease in overall community energy efficiencies as a result of the displacement of commercial and industrial activities to remote locations, and increased state and local government responsibilities in case of disruption of the local systems.

3) For the next 40 to 50 years, and probably much longer, a major fraction of the nation's energy system of production and distribution will rely on centralized energy facilities. Dialogs which focus on solar energy's role in a hybridized complex of centralized and distributed subsystems are, therefore, much more productive than those which cast the situation in an either-or context.

ROBERT NATHANS
*Institute for Energy Research, State University of New York, Stony Brook*

### Archeoastronomy at Pueblo Bonito

Jonathan E. Reyman's article "Astronomy, architecture, and adaptation at Pueblo Bonito" (10 Sept. 1976, p. 957) raises an interesting question about the intended functions of buildings that were purposely astronomically aligned. In 1975, Fisher, O'Flynn, and I reported (*1*) on the same window alignments in Pueblo Bonito to which Reyman refers. His measurements confirm our findings that the two windows open to the winter solstice sunrise. However, we feel that his hypothesis of "adaptive strategy" for the windows is far from settled. That the alignment is real there is no doubt. However, if it is intentional, it is certainly not clear that the alignment ever served to set a calendar. To begin with, because of the angular width of the windows, it is impossible to determine the date of the

solstice very accurately simply from seeing the sun at the center of the windowsill. For example, the window in room 228B is about 6.5° wide as seen from the opposite corner of the room. Without a marker of some sort on the sill, it would be very difficult to judge just when the rising sun appears at the center of the window. Furthermore, there is the problem of where in the room one is to stand to see the sun at the solstice. It is merely a guess that the appropriate place to stand is where the sun at winter solstice sunrise appears at the middle of the sill.

The sun does appear to stand still for several days around the solstice in its yearly journey north to south and back, and this phenomenon could be easily seen from these windows. What is more to the point, though, is that the sun appears to "stand still" near the solstices when seen from any fixed point at any local horizon. In this respect, the sun-watching stations we have discovered in Chaco Canyon (*1*, *2*) are more effective for actually setting a calendar because they allow one to predict accurately the advent of the solstices a number of days before they actually occur. The windows in rooms 225B and 228B are deficient in this respect as well as being poor markers of the winter solstice. We prefer to explain the orientation of these windows by noting that this sort of alignment is similar to the summer solstice alignment of the northeast window in Casa Rinconada (*1*), a great kiva across the canyon from Pueblo Bonito. The windows were likely constructed in Pueblo Bonito to be open to the winter solstice sunrise, which had ceremonial significance.

Because the windows from rooms 225B and 228B connect to rooms at the same level to the southeast, it is probable that there were exterior walls which would block the views from these two rooms and thus make the windows doorways. Reyman discusses this possibility but finds little evidence that there was such a wall. However, he states that the windows are on the third story when, according to his own figure 2 and Judd's plate 15 (*3*), they are on the second story. Furthermore, Reyman's figure 2 gives ample evidence of the probability of a second-story exterior wall.

However, the possible presence of an outside wall obstructing the view from the window fails to defeat the assumption of purposeful astronomical orientation for the windows. As we have noted previously (*1*, *2*), the Zuñi placed ports in their exterior walls to admit the light of the sun on ceremonially and agriculturally important days (*4*). A similar practice could have been followed in Pueblo Bonito, a port in an exterior wall admitting the light of the sun through the corner window at the winter solstice. Such a port could certainly establish a calendar accurately, as the combination of it and the doorway could define the direction of winter solstice sunrise precisely. As judged from Cushing's account, however, the Zuñi ports served only as reminders of the important days, since the sun priest still made his observations from his sun-watching station. As Young (*5*) has demonstrated, the acceptance of the sun into one's room at ceremonially important times of the year has clear religious importance that is supported by ample mythological references as well. Thus I believe that the solar alignment of the corner windows at Pueblo Bonito were of richer significance than Reyman allows for in his article. It may be an example of an early technology serving ritual needs. It seems to me that this could only have happened after the demands for an accurate calendar had been met.

RAY A. WILLIAMSON
*St. John's College, Annapolis, Maryland 21404*

**References**

1. R. A. Williamson, H. J. Fisher, D. O'Flynn, *Native American Astronomy*, A. F. Aveni, Ed. (Univ. of Texas Press, Austin, 1977).
2. R. A. Williamson, H. J. Fisher, A. F. Williamson, C. Cochran, in *Archaeoastronomy in Pre-Columbian America*, A. F. Aveni, Ed. (Univ. of Texas Press, Austin, 1975).
3. N. M. Judd, *Smithsonian Misc. Collect.* **147**, 1 (1964).
4. F. H. Cushing, *My Adventures at Zuni* (Peripetetic Press, Santa Fe, N.M., 1941).
5. M. J. Young, unpublished manuscript.

In that it relies on the present-day lack of sill markers at Pueblo Bonito, Williamson's argument that it was difficult to determine accurately when the sun rose in the center of the windows is weak. As I noted in my article, any markers which may have existed prehistorically in conjunction with the windows have since disappeared. Given the engineering skills of the ancient Chacoans, the placement of markers on the sills or elsewhere would have been an easy task. While the lack of such markers today does not mean they never existed, neither can their former presence be demonstrated. Thus further discussion about them seems pointless.

Even without markers, it is not as difficult as Williamson assumes to determine when the sun rises in the center of each window, especially if one uses the windows in conjunction with topographic features on the horizon. I noted in my article that the use of architectural features in conjunction with horizon calendars is well documented ethnographically for the Pueblos. When looking from

the Pueblo Bonito windows, the use of a horizon calendar would also allow one to predict accurately the advent of the winter solstice sunrise; the windows need not be considered deficient in this regard. The reader should note that the "sun-watching stations" to which Williamson refers are considered by Williamson *et al.* (*1*) to be possible observation sites. Thus, additional evidence is needed before these sites can be used as a standard by which to evaluate the Pueblo Bonito windows.

Williamson's statement that, "It is merely a guess. . . ." puts the cart before the horse. The correct procedure, which was followed, is to test specific hypotheses generated from the ethnographic data for the Pueblos—in this case, that the windows were aligned along their central axes to the winter solstice sunrise. Therefore, we first determined the central axis for each window and then sighted along each axis to the horizon. On the winter solstice, the sun rose at the sighting point on the horizon for each window. For the window in 225B, the central axis can be determined from the intersection of the stones which comprise the bottom edge of the window; this is not possible, however, for the window in 228B, which is constructed differently. The central axis must be determined by physical measurement, a technique which can also be used on the window in 225B.

Williamson notes that these solar alignments may have had religious significance. This is probably true, but his argument ignores the fact, discussed by Rappaport (*2*) and well-documented for the Pueblos (*3–4*), that religious ceremonialism contributes significantly to human adaptation. As I noted, in the case of the Pueblos, the major ceremonials center on the planning and implementation of the farming system. Thus, that the alignment of the windows to the winter solstice sunrise may have had religious significance does not preclude the more fundamental, adaptive function of these architectural features, since the religion itself serves the same adaptive strategy, at least in part. Similarly, that accurate predictions of astronomical events increases priestly power and prestige (*4*, p. 206) does not preclude the more basic function of such predictions to gain a greater understanding of seasonal changes in order to increase the likelihood of a successful harvest. Pueblo religion, at its base, serves to increase the adaptive efficiency of subsistence strategies; therefore, while the alignments may have had "richer significance" as suggested by Williamson, we must first examine them within a framework of ecological adaptation. My article attempted to do this and no more.

Finally, Williamson is correct in pointing out that the windows are in rooms 225B and 228B, not 225C and 228C, as I stated. My error resulted from an attempt to resolve an apparent inconsistency in Judd's (*5*) room designations. In so doing, I mislabeled the rooms. As Williamson notes, however, the alignments are real; they are correct, but my original room designations are not.

JONATHAN E. REYMAN
*Department of Sociology-Anthropology, Illinois State University, Normal 61761*

**References**

1. R. A. Williamson, H. J. Fisher, A. F. Williamson, C. Cochran, in *Archaeoastronomy in Pre-Columbian America*, A. F. Aveni, Ed. (Univ. of Texas Press, Austin, 1975); R. A. Williamson, H. J. Fisher, D. O. Flynn, in *Native American Astronomy*, A. F. Aveni, Ed. (Univ. of Texas Press, Austin, 1977).
2. R. A. Rappaport, *Pigs for the Ancestors* (Yale Univ. Press, New Haven, Conn., 1968); *Annu. Rev. Ecol. Syst.* **2**, 23 (1971).
3. A. M. Stephen, *Hopi Journal* (Columbia Univ. Press, New York, 1936); E. C. Parsons, *Pueblo Indian Religion* (Univ. of Chicago Press, Chicago, 1939); J. E. Reyman, *Mexican Influence on Southwestern Ceremonialism* (University Microfilms, Ann Arbor, Mich., 1971).
4. J. E. Reyman, in *Archaeoastronomy in Pre-Columbian America*, A. F. Aveni, Ed. (Univ. of Texas Press, Austin, 1975).
5. N. M. Judd, *Smithson. Misc. Collect.* **147**, 1 (1964).

## Taxonomists Wanted

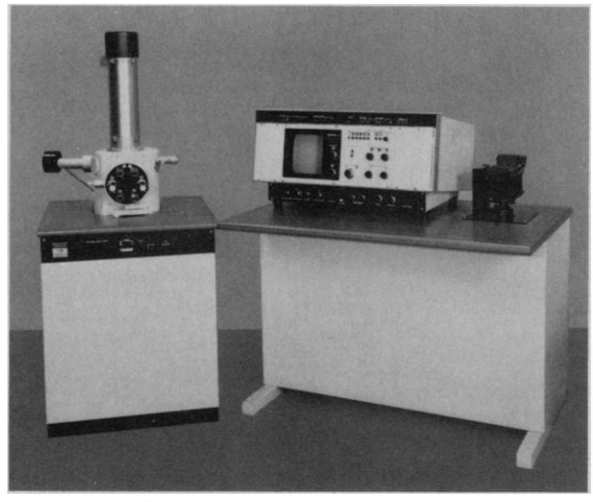
As a chemist with a research interest in archaeology, I have for some time been concerned with increasing contacts between physical scientists and archaeologists. One modest result has been the "Archaeometric Clearinghouse" published recently in the *Journal of Field Archaeology*. It will, it is hoped, lead archaeologists to those physical scientists who are best equipped to extract useful information from archaeological finds and result in useful interdisciplinary collaborations.

The project is actively supported by the Committee on Science in Archaeology of the Archaeological Institute of America. The response has been good, and I have been asked to enlarge the range of the "Clearinghouse." A badly needed roster is one of taxonomic experts who can identify organic remains: wood, seeds, pollen, bones, and so forth. Unfortunately, such specialists, many of whom have never worked on archaeological materials, are difficult to locate.

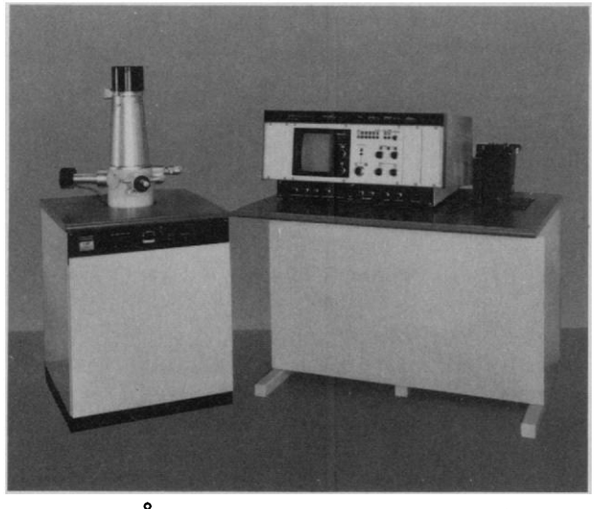
I therefore ask that interested taxonomic specialists in relevant fields send me their names, addresses, and fields of specialization for inclusion in a future listing.

CURT W. BECK
*Department of Chemistry, Vassar College, Poughkeepsie, New York 12601*

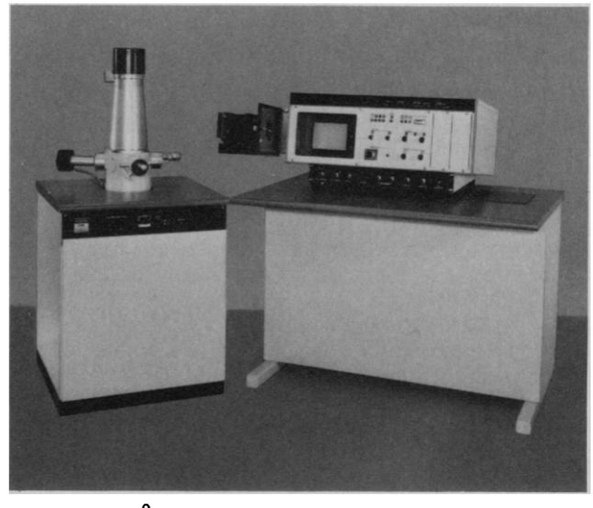
# Hitachi/Perkin-Elmer S-400 Series



S-450: 60Å guaranteed, 20x to 200,000x, 30kV, $38k



S-430: 70Å guaranteed, 30x to 200,000x, 25kV, $32k



S-410: 70Å guaranteed, 30x to 150,000x, 25kV, $30k

# Three research grade SEMs, all under $40k

Patterned after our highly successful S-500 (over 100 in use), the S-400 Series gives you high performance and operational convenience that no other microscope with similar specifications can match. Especially at these prices.

For example, magnification is maintained automatically, despite working distance changes, specimen positioning errors and even sample topography.

Optimum brightness is also maintained automatically, and immediately corrected for changes in operating parameters.

All three S-400 models also have a pushbutton-activated full frame, flicker free mode and a pushbutton selectable, "quick look" low mag (100x) mode. Plus automatic focus compensation for severely tilted samples and a completely automatic evacuation system.

You can also have a wide range of accessories: Hitachi-patented dual magnification, elemental analysis packages, and much more.

Those are just some of the features that make each S-400 model the best buy in its price range. For the full story and a demonstration, call or write: Perkin-Elmer, Instrument Marketing Division, 411 Clyde Avenue, Mountain View, CA 94043. Phone: (415) 961-0461.

**SEE THE S-400 SERIES AT EMSA**

PERKIN-ELMER

Circle No. 138 on Readers' Service Card

12 August 1977, Volume 197, Number 4304 **SCIENCE**



# An International Partnership for Solar Power

In the near future solar energy systems for generating small amounts of on-site mechanical or electrical power could play a substantial role in world energy affairs. The technologies of photovoltaic cells, solar collectors coupled with heat engines, and wind generators are poised for major cost reductions. A comprehensive study* by the congressional Office of Technology Assessment says that on-site solar power systems have the potential to be competitive with central utility power in the United States within 10 to 15 years. But solar power is at present too expensive in the industrial countries that have the expertise for immediate exploitation. What is lacking is the prospect of a market large enough to justify mass production, which in turn would accelerate cost reductions.

In many parts of the developing world, however, on-site solar power systems are competitive today and the potential is enormous. They could have an immediate impact on unelectrified rural areas, where most of the world's people live (96 percent in Africa). Shaft power for pumping water or grinding grain is fundamental to extending the human ability to do work, and electricity for refrigeration or educational television sets could markedly improve the quality of village life. Developing countries are desperately seeking independent, nonpetroleum energy sources, but they do not yet have the capability to implement solar power technologies by themselves.

The economics are instructive. The cost of utility power in the United States averages 3 to 10 cents per kilowatt hour. It runs as high as 45 cents/kwh in urban areas of developing countries. In rural areas, however, power is available only from diesel generator sets at $1/kwh or more, or from primary batteries at about $12/kwh. Complete solar-thermal power systems costing about $4 per peak watt and capable of providing electricity at less than $4/kwh are already available. Photovoltaic systems costing $1 to $2 per peak watt are expected by 1980. The OTA report says that solar devices capable of providing on-site power at much less than $1/kwh could be produced in the next few years.

Solar energy devices have long been proposed as appropriate technology for the developing world. What is less widely appreciated is that they constitute an appropriate, and important, technology for the developed world too. Both stand to gain from a rapid reduction in the costs of solar power, and a cooperative effort would facilitate the process. The analogy that suggests itself is the worldwide effort that led to the high-yield grains of the Green Revolution.

Initially, for example, industrial countries could stimulate their fledgling solar industries by making solar power systems available to developing countries on liberal terms, comparable to those provided in the past for nuclear power systems. France is already marketing a subsidized solar-powered irrigation pump to a dozen countries, and the Mexican government is considering purchase of 1000 units or more. If developing countries are to be the test-bed for solar power, however, they must be actively involved in setting up the programs and choosing the technologies.

As solar technologies begin to mature, developing countries might well choose to set up their own manufacturing plants. Such countries would have complete control over an inexhaustible energy source and a considerable measure of energy self-sufficiency, for perhaps one-tenth the cost in capital and skilled human resources required to establish an indigenous nuclear industry and extend urban power grids into the countryside. The existence of the solar alternative might also provide the best means of limiting nuclear proliferation.

The opportunity is here. But a solar partnership would be more credible to developing countries if the United States were to endorse on-site solar power as an important element in its own energy future and to play an active role in making the technology available to others.—ALLEN L. HAMMOND

**Application of Solar Technology to Today's Energy Needs* (Office of Technology Assessment, Washington, D.C., June 1977).

# YOU HAVE NEVER SEEN A SMALLER SYRINGE.

That needle in the foreground is really a small precision syringe. The tiny tungsten wire behind it fits in the needle and discharges the complete sample. The total capacity of this Hamilton syringe is one microliter... and it's all contained in that needle. With any degree of skill, you can repeatably inject samples to ±1%.

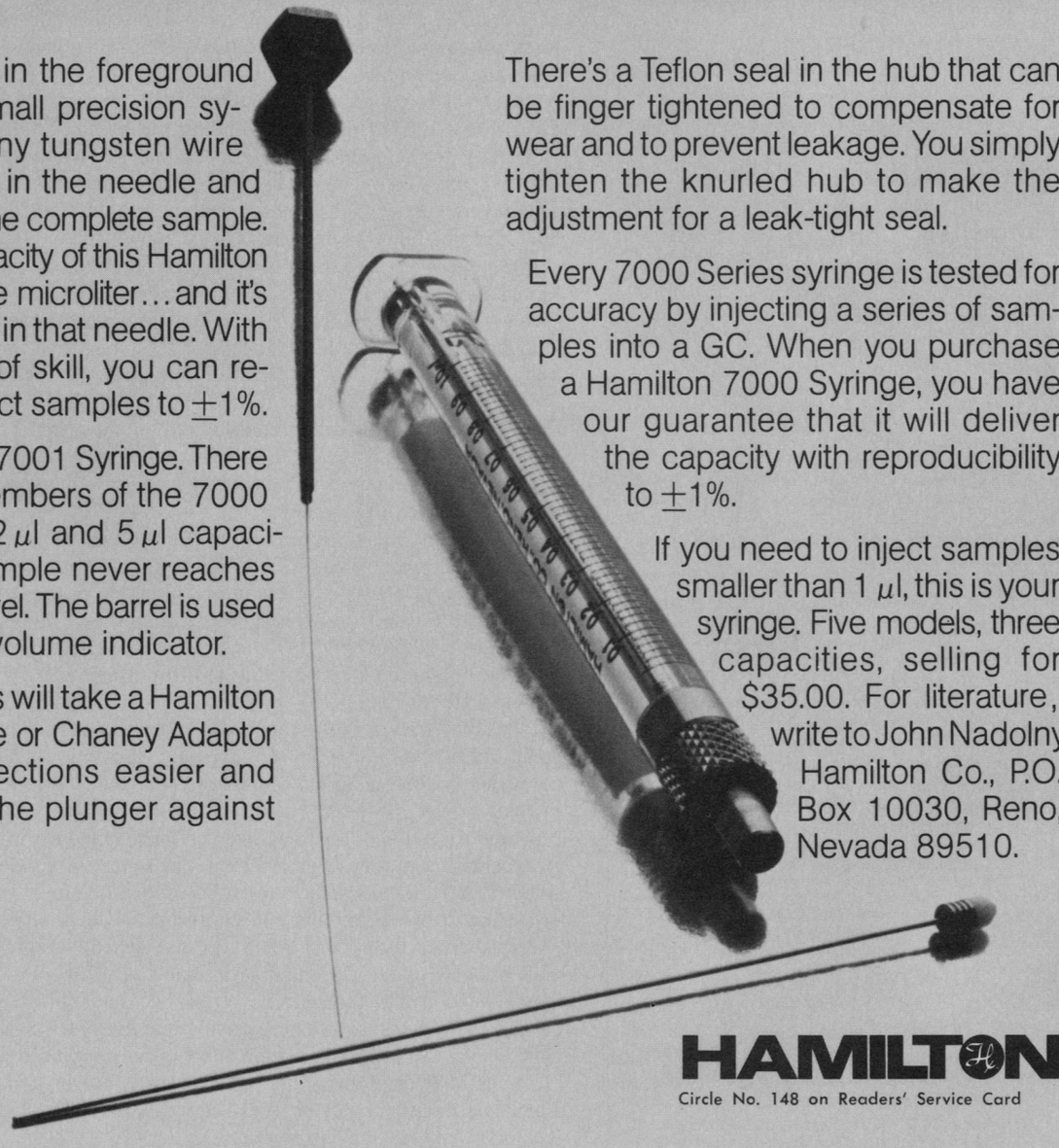
It's called our 7001 Syringe. There are other members of the 7000 Series with 2 μl and 5 μl capacities. Your sample never reaches the glass barrel. The barrel is used simply as a volume indicator.

All the 7000's will take a Hamilton plunger guide or Chaney Adaptor to make injections easier and strengthen the plunger against bending.

There's a Teflon seal in the hub that can be finger tightened to compensate for wear and to prevent leakage. You simply tighten the knurled hub to make the adjustment for a leak-tight seal.

Every 7000 Series syringe is tested for accuracy by injecting a series of samples into a GC. When you purchase a Hamilton 7000 Syringe, you have our guarantee that it will deliver the capacity with reproducibility to ±1%.

If you need to inject samples smaller than 1 μl, this is your syringe. Five models, three capacities, selling for $35.00. For literature, write to John Nadolny. Hamilton Co., P.O. Box 10030, Reno, Nevada 89510.



HAMILTON

Circle No. 148 on Readers' Service Card

## BOOKS RECEIVED AND BOOK ORDER SERVICE

*(Continued from page 654)*

1977. xvi, 250 pp., illus. $22.50. Topics in Cardiovascular Disease.

**Organic Syntheses via Metal Carbonyls**. Vol. 2. Irving Wender and Piero Pino, Eds. Wiley-Interscience, New York, 1977. xvi, 744 pp., illus. $45. *To order this book, circle No. 455 on Readers' Service Card.*

**The $\pi$ $\pi$ Interaction**. J. L. Petersen. CERN, Geneva, 1977. x, 110 pp., illus. Paper. CERN 77-04.

**The Polychaete Worms**. Definitions and Keys to the Orders, Families and Genera. Kristian Fauchald. Natural History Museum of Los Angeles County, Los Angeles, 1977. x, 188 pp., illus. Paper, $7. Science Series 28.

**Reproduction in Domestic Animals**. H. H. Cole and P. T. Cupps, Eds. Academic Press, New York, ed. 3, 1977. xvi, 666 pp., illus. $39.50. *To order this book, circle No. 456 on Readers' Service Card.*

**Science and Government Report International Almanac 1977**. Daniel S. Greenberg, Ed. Science and Government Report, Washington, D.C., 1977. viii, 306 pp. $54; after 1 September, $75.

**Selected Papers from the 26th International Astronautical Congress**. Lisbon, Sept. 1975. Luigi G. Napolitano, Ed. Pergamon, New York, 1976. viii + pp. 317–470, illus. $30. Also published as *Acta Astronautica*, vol. 3, No. 5–6. *To order this book, circle No. 457 on Readers' Service Card.*

**Serotonin in Health and Disease**. Vol. 4, Clinical Correlates. Walter B. Essman, Ed. Spectrum, New York, 1977. xx, 444 pp., illus. $37.50.

**Tornado**. Accounts of Tornadoes in Iowa. John L. Stanford. Iowa State University Press, Ames, 1977. x, 110 pp., illus. Paper, $3.95.

**Unique Properties of Melanocytes**. Proceedings of a conference, Houston, Jan. 1977. V. Riley, Ed. Karger, Basel, 1976. xvi, 430 pp., illus. $63.75. Pigment Cell, vol. 3.

**Vector Fields**. Vector Analysis Developed through Its Application to Engineering and Physics. J. A. Shercliff. Cambridge University Press, New York, 1977. xii, 330 pp., illus. Cloth, $28.50; paper, $7.95.

**What Is It Really Like Out There**? Objective Knowing. Thomas Moorman. Atheneum, New York, 1977. viii, 88 pp. $5.95.

**What Is the World Made Of**? Atoms, Leptons, Quarks, and Other Tantalizing Particles. Gerald Feinberg. Anchor/Doubleday, Garden City, N.Y., 1977. xx, 290 pp. $10.

**The Whole Cosmos Catalog of Science Activities**. Joe Abruscato and Jack Hassard. Goodyear Publishing Company, Santa Monica, Calif., 1977. x, 134 pp., illus. Paper, $9.95. Goodyear Education Series.

**William Beebe**. An Annotated Bibliography. Tim M. Berra. Archon Books (Shoe String Press), Hamden, Conn., 1977. 158 pp., illus. $15.

**Women and Management**. An Expanding Role. Donald O. Jewell, Ed. Georgia State University School of Business Administration, Atlanta, 1977. xii, 414 pp. $11.95.

**Worlds within Worlds**. An Introduction to Biology. Thomas C. Emmel. Harcourt Brace Jovanovich, New York, 1977. xii, 612 pp., illus. + plates. $13.95.

**Your Window Greenhouse**. John Bracken. Drawings by Adrian Martinez. Crowell, New York, 1977. viii, 120 pp. $8.95.